

### Claims

1. A filter system for adsorbing contaminants from a molten carbonate fuel cell exhaust stream comprising

a filter substrate coated with a material, wherein  
5 the material comprises

an inorganic adsorbent secured to the filter substrate by an inorganic binder, and

an acidic material coated onto the filter substrate.

10 2. The filter system of Claim 1 wherein the composition of the filter substrate is selected from a group of materials consisting of ceramic, alumina, titania, zirconia, boria, corundum, silica, magnesia, silica-  
15 zirconia, titania-zirconia, titania-silica, silica-alumina, silicon carbides, cordierite, mullite, and metallic filters, such as stainless steel, iron chromium alloy and other metallic alloy filters and mixtures and combinations thereof.

20 3. The filter system of Claim 1 wherein the filter substrate comprises a metallic filter.

4. The filter system of Claim 1 wherein the inorganic adsorbent is selected from the group consisting of alumina, silica, titania, titania-silica, silica-alumina, zirconia  
25 silica-zirconia, ceria, and zeolites, either modified or unmodified.

5. The filter system of Claim 1 wherein the inorganic

adsorbent comprises a high surface area material selected from the group consisting of alumina, silica, titania, zirconia, ceria, titania-silica, silica-alumina, silica-zirconia and zeolites.

5           6.    The filter system of Claim 1 wherein the inorganic adsorbent comprises a high surface area alumina with a surface area greater than about 100 m<sup>2</sup>/g.

7.    The filter system of Claim 1 wherein the inorganic binder for binding the inorganic adsorbent to the filter substrate is selected from the group consisting of sols of alumina, silica, zirconia, ceria, titania, boehmite and aluminum nitrate, and blends of two or more different binders.

8.    The filter system of Claim 1 wherein the filter substrate comprises a stainless steel screen and the inorganic binder comprises ceria.

9.    The filter system of Claim 1 wherein the acidic material comprises an inorganic acid.

10.   The filter system of Claim 1 wherein the acidic material comprises a non-water soluble inorganic acid.

11.   The filter system of Claim 1 wherein the acidic material comprises heteropolyphosphoric acid.

12.   The filter system of Claim 1 wherein the inorganic adsorbent comprises about 60 to about 95 percent, the inorganic binder comprises about 5 to about 40 percent and the acidic material comprises about 0.1 to about 20 percent

of the material coated on the filter substrate.

13. The filter system of Claim 1 wherein the inorganic adsorbent comprises about 80 to about 95 percent, the binder comprises about 1 to about 20 percent and the acidic material comprises about 0.1 to about 5 percent of the material coated on the filter substrate.

14. A filter system for adsorbing contaminants from an exhaust system from a molten carbonate fuel cell prior to passage of the exhaust stream through an oxidation catalyst comprising

a filter substrate,

a high surface area inorganic adsorbent secured to the filter substrate by an inorganic binder, and

an inorganic acidic material coated onto the filter substrate.

15. A process for preparing a filter system for filtering exhaust gases from a molten carbonate fuel cell prior to passage through an oxidation catalyst comprising

preparing a filter substrate,

coating the filter substrate with an inorganic adsorbent by use of an inorganic binder, and

treating the coated filter substrate with an acidic material.

16. A process for preparing a filter system for filtering exhaust gases from a molten carbonate fuel cell comprising preparing a filter substrate and coating the

filter substrate with a blend of an inorganic adsorbent, an inorganic binder and an acidic material.

17. A process for filtering contaminants which are present in an exhaust stream of a molten carbonate fuel cell comprising

passing a fuel stream through the molten carbonate fuel cell,

passing at least a portion of an exhaust stream containing inorganic contaminants through a filter system, and

filtering the inorganic contaminants from the exhaust stream by use of the filter system, wherein the filter system comprises a filter substrate, an inorganic adsorbent secured to the filter substrate by an inorganic binder and an acidic material coated onto the filter substrate.

18. The process of Claim 18 further comprising passing at least a portion of the filtered exhaust stream after passage through the filter system through an oxidation catalyst system.

19. An exhaust treatment system for adsorbing contaminants from a molten carbonate fuel cell comprising the filter system of Claim 1 and an oxidation catalyst.

20. An exhaust treatment system for adsorbing contaminants from a molten carbonate fuel cell comprising the filter system of Claim 14 and an oxidation catalyst.

21. A process for filtering contaminants which are present in an exhaust stream of a molten carbonate fuel cell comprising

5        passing a fuel stream through the molten carbonate fuel cell which generates an exhaust stream containing inorganic contaminants,

      passing at least a portion of the exhaust stream containing inorganic contaminants through a filter system,

10       filtering the inorganic contaminants from the exhaust stream by use of the filter system, wherein the filter system comprises a filter substrate, an inorganic adsorbent secured to the filter substrate by an inorganic binder and an acidic material coated onto the filter substrate and

15       passing the filtered exhaust stream through an oxidation catalyst.

22. A process for preparing an exhaust treatment system for filtering exhaust gases from a molten carbonate fuel cell comprising

20       preparing the filter system of Claim 1,  
      preparing an oxidation catalyst for fuel cells,  
and

25       placing the filter system and the oxidation catalyst on-line to filter the exhaust gases from the molten carbonate fuel cell.